

REMARKS

The Office Action dated April 3, 2009 has been received and carefully studied.

By the accompanying amendment, claims 5-21 have been cancelled without prejudice to filing one or more divisional applications with respect thereto.

The Examiner objects to the drawings for failing to teach what each bar in the figures is referring to as described in the specification and with respect to the claims. By the accompanying amendment, FIGS. 1-3 have been amended to insert reference numbers, and the text of Examples 1 and 2 has been amended accordingly.

The Examiner objects to the specification because the section entitled "Disclosure of the Invention" contains discussions of prior art documents. By the accompanying amendment, the specification has been amended by moving "DISCLOSURE OF THE INVENTION" to the appropriate location in the specification.

The Examiner requires that the thermotropic type nematic liquid E-8 be capitalized and accompanied by the generic terminology. By the accompanying amendment, the specification has been amended to refer to E-8 as E-8 liquid crystal. The term is already capitalized.

The Examiner rejects claim 1 under 35 U.S.C. §103(a) as being unpatentable over Davis-Gillian, U.S. Patent No. 5,861,931, and claims 2-3 as being unpatentable over Davis-Gillian in view of Ichimura, U.S. Patent No. 6,011,277. The Examiner states that Davis-Gillian teaches the claimed retardation element, but does not specifically teach the claimed birefringence layer oriented in a micropattern form. The Examiner notes that David-Gillian teaches a process of patterning the polymer film, and concludes that since there is recognition of this feature, the claimed oriented micropattern form is a result-effective variable that is subject to routine experimentation for the purpose of providing the desired birefringence to the invention. The Examiner cites Ichimura for its disclosure of the claimed photoactive groups.

By the accompanying amendment, claim 1 has been amended to make clear that the liquid crystalline or non liquid crystalline polymer has the photoactive groups in the structure of the polymer molecular (see page 14, lines 14-18; and from page 16, last line to page 25, line 11 of the present specification); only the axes of the photoactive groups of the polymer are oriented in a micropattern form by photo orientation treatment (see page 36, lines 6-14; page 41, lines 21-23, and Fig. 1); and further an axis of

birefringence molecules of the birefringence layer is oriented in a micropattern form which is controlled by orientation of the axis of the photoactive groups (see from page 36, line 4 from the bottom to page 37, line 3).

Davis-Gillian (US 5,861,931) nowhere discloses use of a thin layer of the polymer having the photoactive groups in the structure of the polymer molecular. In Davis-Gillian, the anisotropic dye molecule added to the polarization rotators or the LCP 16 is used for polarization of incoming unpolarized light by absorbing a light with aligned dye molecules (column 4, lines 20 to 26; Fig 5; and column 1, line 10-18). Polarization of incoming unpolarized light is not carried out by the present photoactive groups in the structure of the polymer molecular. The present retardation element does not have a polarization function and has only a retardation function, and the alignment of the present photoactive groups is only used for controlling the alignment of birefringence molecules of the birefringence layer. Accordingly, the function of the anisotropic dye in Davis-Gillian is entirely different from the function of the present photoactive groups of the polymer molecular.

Further, the Examiner states that "In addition, the reference also teaches photo-orientation of polymers see at

least Col. 3, lines 25 through 51." (page 3 in the Office Action). However, in the present invention, photo-orientation is carried out only to the photoactive groups and not to the polymer itself. Davis-Gillian never discloses photo-orientation of photoactive groups of polymers.

Further, in Davis-Gillian, the birefringence layer (patterned alignment of layer 10) includes at least one of first and second regions comprising twisted birefringent material such as region A in Fig 1 to 3 for rotation of linear polarized light (abstract, claims and Figs. 1 to 3). Also, in the input face, the alignment of birefringent molecules is the same in region A and region B as shown in Figs. 1 to 3, and the alignments of birefringent molecules in region A and region B do not form a pattern in the input face and only in the output face, a pattern by the alignments of birefringent molecules in region A and region B is formed. According to the present invention, alignments of birefringent molecules in the birefringent layer form the same micropattern form in both sides of input face and output face and, twisted alignments of birefringent molecules as shown in Davis-Gillian are not included. The rotation of linearly polarized light by twisted birefringent materials never happens in the present

invention. The present retardation element compensates the retardation of linearly polarized light. Accordingly, the present retardation element is very different from a patterned polarization-rotating optical element of Davis-Gillian in the structure of the birefringence layer and also the function of the elements.

Further, in Davis-Gillian, the alignment of birefringence molecules of the birefringence layer (patterned alignment of layer 10 of Fig. 4) is formed by spinning a thin layer of polyimide onto the glass substrate 11 and rubbing the surface of the layer 10 through a mask to produce the desired alignment direction patterning, or, alternatively, the layer 10 may be formed as a polymer film which has been illuminated by linearly polarized light through suitable masking wherein the polymer film is made by using lithographic techniques from a linearly photo polymerizable (LPP) layer (column 3, line 35 to 51), and the birefringence layer (patterned alignment of layer 10) includes at least one of first and second regions comprising twisted birefringent material such as region A in Figs. 1 to 3 for rotation of polarization of light, as stated above. Accordingly, in the region A comprising twisted birefringent material, alignment of axes of birefringent molecules have to twist from the input face to

the output face in the film as shown in Figs. 1 to 3 and, if the twisted alignment of axes of birefringent molecules is made by a rubbing method, rubbing must be carried out in different directions in the input face and output face.

Further, it is impossible or very difficult to control the retardation region in micron unit by the rubbing method or photo-polymerization method described in Davis-Gillian. However, in the present invention, it is very easy to control the retardation region in micron unit because alignment of an axis of birefringence molecules of the birefringence layer is controlled by alignment of axes of photoactive groups of polymers in micropattern form.

In the present retardation element, alignment of axes of birefringent molecules in the birefringent layer is made only by forming the birefringent layer on a thin film layer of a liquid crystalline or non liquid crystalline polymer having photoactive groups, wherein the axis of the photoactive groups are oriented in a micropattern form by photo orientation treatment. Davis-Gillian does not disclose or suggest the present retardation element comprising a thin film layer of a polymer having photoactive groups wherein the axis of the photoactive groups are oriented in a micropattern form by

photo orientation treatment and a birefringence layer formed so as to contact with said thin film layer wherein an axis of birefringence molecules of the birefringence layer is oriented in a micropattern form which is controlled by orientation of the axis of the photoactive groups.

With respect to the rejection of claims 2 and 3 under 35 U.S.C. §103(a) as being unpatentable over Davis-Gillian (US 5,861,931) in view of Ichimura (US 6,001,277), these claims are believed to be allowable by virtue of their dependence. In addition, Ichimura discloses a liquid-crystal alignment film used in a liquid-crystal display device wherein said liquid-crystal alignment film comprises a resin which is chemically combined with a first constituent unit wherein said first constituent unit is photoisomerizable and dichroic (column 4, lines 8-24), and discloses polymers having non-aromatic N=N, non-aromatic C=C and non-aromatic C=N as examples of the resin (column 14 to 25, Formula (1)-(28) and, further, discloses that the alignment film has insufficient stability in the ability to cause liquid crystal alignment (column 5, line 17-30), that Ichimura's liquid crystal alignment film having stability in the ability to cause liquid crystal alignment can be obtained

by using a resin having a reactive functional group such as an acryloyl group, etc. (column 5, line 31-60).

Although Ichimura discloses a liquid-crystal alignment film comprising a resin having the present photoactive groups, Ichimura further discloses that the alignment film has insufficient stability in the ability to cause liquid crystal alignment and does not disclose use for a retardation element. In particular, it does not disclose or suggest that the axis of the photoactive groups can be arranged to align in a micropattern form by photo treatment and the micropattern form alignment of the photoactive groups of the polymer can control alignment of axes of birefringent molecules to a micropattern form, stably, although, it is impossible or very difficult to control alignment of axes of birefringent molecules to micropattern form by a rubbing method.

The Examiner's indication that claim 4 contains allowable subject matter is noted with appreciation.

Reconsideration and allowance of all pending claims is noted with appreciation.

Respectfully submitted,


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